

Registration of Two Improved Yellow-Flowered Alfalfa Germplasms

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IAMF101 and IAMF102, yellow-flowered alfalfa [*Medicago sativa* subsp. *falcata* (L.) Arcang.] populations, were developed by the Raymond F. Baker Center for Plant Breeding at Iowa State University, Ames, IA and the U.S. Dairy Forage Research Center (USDA-ARS), Madison, WI. These populations were released by the Iowa State University Research Foundation in September 2006. IAMF101 is designated as Reg. No. GP-347 PI 643446 and IAMF102 is designated as Reg. No. GP-348 PI 643447 in the national plant germplasm system (NPGS).

IAMF101 is a genetically broad based tetraploid ($2n = 4x = 32$) *Medicago sativa* subsp. *falcata* germplasm, and has pods that range from *M. falcata* (sickle-shaped) (~70%) to single coiled. IAMF101 was developed by two cycles of recurrent phenotypic selection for persistence, autumn regrowth, and vigor from a broad based, yellow-flowered alfalfa germplasm collection. It was previously known by the name "IAFAL." The parent plants were selected on 22 Sept. 1999 from a germplasm evaluation trial at the Iowa State University Agronomy and Agricultural Engineering Farm near Ames, IA that had been planted in spring 1997. Selection was based on yield performance, freedom from disease and insect pests, and autumn regrowth. The 36 selected parents of IAMF101 derived from the following sources (number of plants in parentheses): IA-3018 (Kehr, 1973) (3), PI 314092 (2), PI 315476 (2), PI 384507 (4), PI 494661 (2), PI 502441 (2), PI 502450 (2), PI 502453 (3), PI 505872 (1), PI 538985 (1), PI 538989 (1), PI 538993 (1), PI 538994 (2), PI 573175 (1), PI 631597 (4), PI 631806 (2), WISFAL (Bingham, 1993) (3). The experimental yellow-flowered alfalfa population IA-3018 is an 11-clone synthetic of diverse origin developed at Iowa State University by C.P. Wilsie in the 1960s (Kehr, 1973).

Parental plants were intercrossed by hand in the greenhouse at Ames, IA during the winter of 1999–2000 and equal quantities of seeds from each parent were bulked. Seeds were germinated in spring 2000 in the greenhouse, and approximately 1000

seedlings were transplanted to the field at the Iowa State University Agronomy and Agricultural Engineering Farm at Ames, IA in May 2000. In September 2003, 56 plants were selected based on persistence, vigor, and autumn regrowth, moved to the greenhouse, and intercrossed. Equal quantities of seed from each plant were bulked to form the Syn 1 generation of IAMF101. Syn 2 seed was produced in Idaho in 2004 and 2005.

IAMF102 is a genetically broad based tetraploid ($2n = 4x = 32$) yellow-flowered alfalfa (*Medicago sativa* subsp. *falcata*) germplasm, and has pods that range from *M. falcata* (sickle-shaped) (~70%) to single coiled. IAMF102 was developed from one cycle of selection. It was previously known by the name "HFAL." The parent plants derived from the following germplasms (number of plants in parentheses): 5291/88 (1), 5299/88 (1), IA-3018 (Kehr, 1973) (4), Lodgepole (Smith, 1997; Boe et al., 2006) (2), PI 314092 (2), PI 468015 (1), PI 494661 (1), PI 502441 (2), PI 502453 (2), PI 631579 (3), PI 631597 (1), PI 631796 (4), PI 631857 (3), SD 201 (Boe et al., 1998) (1), WISFAL (Bingham, 1993) (4). The germplasms 5291/88 and 5299/88 were obtained from the Institute of Agrobotany, Hungary. The experimental yellow-flowered alfalfa population IA-3018 is an 11-clone synthetic of diverse origin developed at Iowa State University by C.P. Wilsie in the 1960s (Kehr, 1973). 'Lodgepole' is naturalized *M. falcata* population found in the Grand River National Grassland near Lodgepole, SD (Smith, 1997; Boe et al., 2006). The SD 201 plant was tetraploid and was developed by treating seed of the SD 201 germplasm (Boe et al., 1998) with colchicine. The 32 parental genotypes were selected from among 104 genotypes that had been testcrossed to four elite alfalfa (*Medicago sativa* subsp. *sativa* L.) populations. Selections were based on testcross performance for yield in field trials at the Iowa State University Agronomy and Agricultural Engineering Farm near Ames, IA and at the Iowa State University Northeast Research Farm near Nashua, IA from 2002 to 2003 (Riday and Brummer, 2003; 2004; 2005). Parents were intercrossed by hand without emasculation in the greenhouse during the winter 2003–2004. Equal quantities of seed were bulked from each parent to constitute the Syn 1 generation of the IAMF102 population. Syn 2 seed was produced in Idaho in 2004 and 2005. IAMF102 has approximately a 20% frequency of 'creeping rooted' alfalfa plants. Creeping rooted plants are characterized by non-distinct crowns and root systems with no distinct single tap root, rather plants form 'mats' of growth with 'fibrous' root systems. Source populations of the creeping rooted trait are PI 494661, PI 631579, and PI 631857.

Both populations were entered into biomass yield variety trials seeded in April of 2005 at: Iowa State University

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Agronomy and Agricultural Engineering Research Farm, Boone County, Ames, IA, University of Wisconsin Agricultural Research Stations at Arlington, Columbia County, WI and Marshfield, Wood County, WI (Undersander et al.,

2005; 2006), John Bertram Farm, Malone, Fond du Lac County, WI (Undersander et al., 2005; 2006), and U.S. Dairy Forage Research Center Dairy, Prairie du Sac, Sauk County, WI. The two *M. falcata* populations were compared

Table 1. Forage dry matter yield (Mg ha⁻¹) of IAMF101 and IAMF102 (*Medicago sativa* subsp. *falcata*) compared with 'Oneida VR' and 'Vernal' (*Medicago sativa* subsp. *sativa*) taken from five variety trials (Ames, IA, Arlington, WI, Fond du Lac, WI, Marshfield, WI, and Prairie du Sac, WI) planted in April 2005 and harvested during 2005 and 2006 growing seasons.

Germplasm	Forage Dry Matter Yield							
	2005			2006				
	Cut 1	Cut 2	Total	Cut 1	Cut 2	Cut 3	Cut 4	Total
Mg ha ⁻¹								
Ames, IA								
		Aug 23		May 22	Jun 23	Jul 24	Aug 23	
IAMF101	–	2.7	–	5.9	3.0	3.4	1.6	14.0
IAMF102	–	2.5	–	6.5	3.2	3.5	1.6	14.8
Oneida VR	–	2.9	–	6.2	5.2	4.3	2.6	18.3
Vernal	–	3.1	–	6.3	5.2	4.1	2.5	18.1
Trial Mean	–	2.7	–	6.1	4.2	3.7	2.2	16.2
LSD (<i>p</i> < 0.05)		0.4		0.6	0.5	0.5	0.3	1.0
Arlington, WI								
	Jul 11	Aug 15		May 20	Jun 24	Jul 30	Sep 1	
IAMF101	2.3	4.7	6.9	6.6	5.4	5.5	2.5	20.5
IAMF102	2.0	4.3	6.3	6.5	5.5	4.7	2.2	18.5
Oneida VR	2.2	3.5	5.7	5.8	5.7	5.4	3.3	20.3
Vernal	2.2	4.1	6.4	5.5	5.2	5.0	3.2	18.7
Trial Mean	2.3	3.8	6.1	6.0	5.8	5.6	3.6	21.0
LSD (<i>p</i> < 0.05)			0.7					1.5
Fond du Lac, WI								
	Jul 11	Aug 22		Jun 9	Jul 15	Aug 15		
IAMF101	2.8	1.3	4.1	6.2	2.1	0.4	–	8.8
IAMF102	2.5	1.6	4.1	7.4	1.8	0.3	–	9.5
Oneida VR	2.7	1.6	4.3	7.4	3.9	1.4	–	12.7
Vernal	2.6	1.4	4.0	6.8	3.4	1.2	–	11.2
Trial Mean	2.8	1.6	4.4	6.3	3.5	1.2	–	11.1
LSD (<i>p</i> < 0.05)			0.7					1.5
Marshfield, WI								
	Jul 7	Aug 17		Jun 9	Jul 12	Aug 18	Oct 20	
IAMF101	2.5	0.9	3.6	5.3	1.7	2.4	0.6	9.8
IAMF102	2.3	1.0	3.3	5.6	1.6	2.3	0.4	10.1
Oneida VR	2.1	1.3	3.4	4.5	2.3	2.2	1.4	10.0
Vernal	2.0	1.3	3.3	4.2	2.0	1.9	1.2	9.2
Trial Mean	2.3	1.1	3.4	4.9	2.4	2.2	1.3	10.7
LSD (<i>p</i> < 0.05)			0.5					1.1
Prairie du Sac, WI								
				Jun 5	Jul 14	Aug 22		Total
IAMF101	–	–	–	5.5	2.8	2.4	–	10.7
IAMF102	–	–	–	5.4	2.9	2.2	–	10.5
Oneida VR	–	–	–	5.3	3.0	2.6	–	10.9
Vernal	–	–	–	5.4	3.1	2.5	–	11.0
Trial Mean	–	–	–	5.2	2.6	2.3	–	10.1
LSD (<i>p</i> < 0.05)				0.8	0.4	0.4		1.1

with common entries of 'Oneida VR' and 'Vernal' planted in all trials (Table 1). During the establishment year in 2005, the Ames, IA trial was harvested once for biomass yield and the Arlington, WI, Fond du Lac, WI, and Marshfield, WI trials were harvested twice. During the first full production year of 2006, the Ames, IA, Arlington, WI, and Marshfield, WI trials were harvested four times and the Fond du Lac, WI and Prairie du Sac trials harvested three times (Table 1).

IAMF101 and IAMF102 yields similar to Vernal and Oneida VR in some environments, but has lower yields in the others (Table 1). Characteristic of *M. falcata* germplasm, both IAMF101 and IAMF102 show dormancy-induced yield declines during August and October harvests. During the second selection cycle of IAMF101, selection against fall dormancy resulted in superior autumn dry-matter yields compared to IAMF102 (Table 1). IAMF102 has good late spring dry-matter yields, a characteristic commonly found in *M. falcata* germplasm (Table 1).

No specific disease selection has been accomplished in IAMF101 or IAMF102, and IAMF101 and IAMF102 show 23% and 25% resistance respectively to phytophthora root rot (caused by *Phytophthora megasperma* Drechs. F. sp. *medicaginis*) and both populations show 3% resistance to sclerotinia crown and stem rot (caused by *Sclerotinia trifoliorum* Eriks.).

Syn 2 seed of IAMF101 and IAMF102 is maintained by the U.S. Dairy Forage Research Center, USDA-ARS, and 200 seed quantities will be provided on request to Heathcliffe Riday (riday@wisc.edu), US Dairy Forage Research Center, 1925 Linden Drive West, Madison, WI 53706. These germplasms are available for research purposes, including development and commercialization of new varieties and cultivars; we request that appropriate recognition be made of the source when this germplasm contributes to a new cultivar. U.S. plant variety protection has not been requested for these two germplasms.

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